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DOI:

[10.1515/mp-2017-0011](https://doi.org/10.1515/mp-2017-0011)

Document Version

Publisher's PDF, also known as Version of record

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Citation for published version (APA):

Brewer, B. (2017). Material Objects and their Parts. *Metaphysica*, 18(1), 15-31. <https://doi.org/10.1515/mp-2017-0011>

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Material Objects and Their Parts

DOI 10.1515/mp-2017-0011

Published online March 23, 2017

Abstract: Commonsense appears committed to enduring macroscopic material objects that exclude each other from their precise location at all times. I elaborate a specific version of the commonsense commitment and consider its merits in connection with an important line of objection concerning the relation between material objects and their parts. The central thesis is that amongst persisting macroscopic material objects there are Natural Continuants, NCs, whose unity at a time and over time is entirely independent of our concepts, which occupy their precise spatial location Exclusively at all times, and which ground Artificial Continuants, ACs, by partition, collection, and approximation. I call the position the Natural Continuants View (NCV). Section “The Natural Continuants View” offers a provisional characterization. Section “Spatial Partition” considers a familiar puzzle concerning the idea that material objects may survive the loss of a part in order to provide intuitive motivation for (NCV) and to elaborate its commitments concerning (spatial) parts. The result is an account of the way in which NCs ground ACs by spatial partition. Section “Collection and Approximation” turns to a consideration of collections and assemblages of NCs. Section “Conclusion” concludes.

Keywords: Natural Continuant (NC), Artificial Continuant (AC), Exclusivity, spatial partition, collection, approximation

1 Introduction

Our commonsense world-view appears committed to the existence of enduring mind-independent macroscopic material objects that exclude each other from their precise location at all times. This idea is the target of a great deal of metaphysical scrutiny and criticism (Quine 1950, 1960; Chisholm 1973; Unger 1979; Wiggins 1980, 2001; Lewis 1986; Van Inwagen 1990; Sider 2001, 2013). My aim here is to elaborate a specific version of the commonsense commitment and to consider its merits in connection with an important line of objection concerning the relation between material objects and their parts. Its central thesis is that

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amongst persisting macroscopic material objects there are Natural Continuants, NCs, whose unity at a time and over time is entirely independent of our concepts, which occupy their precise spatial location Exclusively at all times, and which ground Artificial Continuants, ACs, by partition, collection, and approximation. I call the position the Natural Continuants View (NCV). Section “The Natural Continuants View” offers a provisional characterization. Section “Spatial Partition” considers a familiar puzzle concerning the idea that material objects may survive the loss of a part in order to provide intuitive motivation for (NCV) and to elaborate its commitments concerning (spatial) parts. The result is an account of the way in which NCs ground ACs by spatial partition.¹ Section “Collection and Approximation” turns to a consideration of collections and assemblages of NCs. Section “Conclusion” concludes. My aim is not to establish (NCV) as the one truth in the area, but rather to argue that its merits are at least worthy of consideration alongside those of other candidate views of the nature of macroscopic material objects.

2 The Natural Continuants View

(NCV) claims that there are Natural Continuants: persisting macroscopic material objects that are wholly naturally unified, both at a time and over time. Their unity at a time and over time is entirely independent of our concepts. They are characterized by the following condition that I call Exclusivity: if o and o^* are NCs and there is a time at which they are precisely colocated, then $o = o^*$.² In other words, no two distinct NCs are ever precisely colocated. This principle is intended to capture our intuitive conviction that, with respect to the most basic material continuants at least, no two distinct such things materially occupy precisely the same spatial extent at any time. For they exclude each other from that location. Failures of Exclusivity should be understood as involving at least one entity of a less basic and more dependent kind.

¹ See my “Exclusive Individuals” (2015) for extended discussion of an equally familiar puzzle often supposed to put pressure on the Exclusivity of enduring NCs that leads to a parallel account of the way in which NCs ground ACs by temporal partition. Unless necessary in what follows, I leave these considerations aside.

² As it stands, this is simply a necessary condition for Natural Continuant status. Conjoined with the stipulation that o and o^* are both persisting macroscopic material objects I intend Exclusivity to be sufficient. Although I have no precise definition of persisting macroscopic material objects, I would begin by giving paradigm examples such as stones, trees, and animals.

I take plausible examples of NCs to include individual animals, vegetables, and (unified portions of) minerals, though even our best hypotheses as to NC status may be subject to correction in the light of further investigation. First, there are naturally occurring things, such as (a) a cat that is conceived, grows inside its mother and is born, lives an active life, perhaps loosing a tail on the way, dies and eventually disintegrates by decomposition; (b) an acorn that falls from an oak, sprouts in the ground and grows to become a grand old oak that is finally destroyed by loggers; and (c) a rock that detaches and falls from a cliff, gradually eroding to become a small pebble and perhaps even a grain of sand on the beach before vanishing altogether. Second, there are also human-made NCs, such as (d) a coin, minted and much used, discarded out of circulation, battered and bent, used as tool to open tins, and winding up in a museum collection before finally melting away in a fire.

Four-dimensional perdurants, on the other hand, fail the Exclusivity condition. For, in the sense in which there is one persisting such thing precisely occupying a given spatial extent at a given time, there are many that all share the temporal part that is more strictly there then. Thus, (NCV) is intended to be incompatible with four-dimensionalism.³

(NCV) further claims that NCs metaphysically ground Artificial Continuants by partition, collection, and approximation. The idea is that ACs are unified at a time and over time, on the basis of a more fundamental domain of NCs, at least in part by our conceptual delineation. Such derivative unification operates in various ways, including the spatial partitioning of an NC by our designation of a sub-region of its spatial extent, say; our collection of appropriately related or functionally similar NCs at a time or over time; and our approximation of the overall behaviour of a coordinated assemblage of NCs to that of a single such thing. These modes of grounding by what might be called ‘artificial unification’ may also be combined. They are illustrated and elaborated further below.

ACs fail Exclusivity, both amongst themselves and with NCs. There may be ACs, a and a^* , such that there is a time at which they are precisely colocated, yet $a \neq a^*$; and there may be an AC, a , and an NC, o , such that there is a time at which they are precisely colocated, yet $a \neq o$. This is possible in their case, in contrast with the Exclusivity characteristic within the NCs, because ACs’ basic properties are derived from their grounding NCs.

Examples of what I take to be ACs according to (NCV) include arbitrary conceptually delineated spatial parts of NCs, such as (a) the whole of Tibbles the cat except for his tail; collections of appropriately related NCs, such as (b) a

³ I understand the idea of a persisting macroscopic material object precisely occupying a spatial location in this way throughout.

chess set; and coordinated assemblages of NCs, such as (c) a watch.⁴ It is crucial in all these cases, though, to recognize that these are indeed ACs and not NCs. For, as I illustrate in what follows, failure to respect this distinction is a source of significant philosophical error and confusion.

3 Spatial Partition

Consider the familiar tale of Tibbles. Tibbles is a normal cat with an impressive tail sitting on a mat. Call the object consisting of all of Tibbles except for his tail ‘Tib’. Suppose that Tibbles’ tail is removed at time t . Surely Tibbles survives the loss and sits on the mat tailless after t . Equally surely, Tib remains on the mat after t too. For Tib is hardly touched by the removal of Tibbles’ tail. It is natural to assume that there is only one thing on the mat after t . Hence Tibbles must be (identical to) Tib. But this cannot be. Since Tib was a proper part of Tibbles and so they cannot be identical.

Philosophers have responded in almost every possible way to this problem.⁵ I do not propose to engage here in a full exposition and assessment of the

⁴ I explain below the various different, and indeed competing, ways in which these collections and assemblages may be artificially unified.

⁵ Nihilists deny the existence of Tibbles and every other putative composite macroscopic thing, including of course Tib (Unger 1979; Dorr and Rosen 2002; Sider 2013). Microscopic metaphysical simples never compose. Talk of all composite ‘objects’ is to be paraphrased away as talk about the relevant simples arranged and behaving in certain ways. Near nihilists under the influence of Van Inwagen deny the existence of Tib. Simples only compose when they constitute a life. Talk of all inanimate composites is again to be paraphrased away (Van Inwagen 1990; Merricks 2001). Mereological essentialists deny that Tibbles survives the loss of his tail. Nothing strictly survives the loss of any part – all its parts are essential – but it may be followed by a series of strictly distinct entia successiva that provide nearly-truth-makers of our common-sense talk of persisting things (Chisholm 1973, 1975; Van Cleve 1986). Michael Ayers (1991b, 236) denies that Tib remains after t , presumably since Tib is supposed essentially to be a proper part of Tibbles. Sortalists deny that there is only one thing on the mat after t . Determinately individuating a single persisting material object requires subsumption under a sortal concept; and this may lead to the distinction between two or more such things in the same place at the same time, such as Tibbles and Tib – one cat and one animal-part, say – both on the mat after t (Wiggins 1967, 1968, 1980, 2001; Thompson 1998). Relativists insist that identity itself is relative to a sortal concept. There are distinct non-extensionally-equivalent identity relations that do not mix transitively (Geach 1967, 1973, 1980; Griffin 1977). What is on the mat after t may be the same cat as Tibbles and the same animal-part as Tib without contradicting the fact that Tibbles and Tib are not related by either the same-cat or the same-animal-part identity relation. Occasionalists insist that identity may be temporary and again therefore not simply transitive (Gallois 1998). Tib was not identical to Tibbles before t but is so after t . Four-dimensionalists

relative merits of all of these solutions. Instead, I present what strikes me as a perfectly natural alternative to all of them that provides a springboard for the discussion to follow.⁶ This is to accept that both Tibbles and Tib exist as persisting material things. Both survive the intervention at t . Tibbles is a naturally unified individual continuant that excludes any other such thing from its precise location at any time. Tib, on the other hand, is a dependent entity grounded upon Tibbles by a mode of abstraction involving the concept of a tail-complement. Tib's precise colocation with Tibbles from t is therefore unproblematic. For its basic material properties are derived from Tibbles by the relevant abstraction. What nevertheless distinguishes it from that grounding NC is its artificial unification on the basis of our concept of a tail-complement; a concept that encompasses less than the whole region occupied by Tibbles before t and the whole of Tibbles' extent after t . Put in terms of (NCV), Tib is an AC grounded upon the Exclusive NC Tibbles by spatial partition on the basis of the concept of a tail-complement. For the remainder of the present section I attempt to work out the implications of making an adequate and unified solution to the paradox of Tibbles and other similar cases of the loss, and gain, of parts from this (NCV) proposal.

(NCV) regards NC/AC status as essential to the persisting macroscopic material objects that have it. For the source of their metaphysical unity, both at time and over time, is quite different in the two cases. So Tib does not become an NC when Tibbles' tail is removed at t . This is crucial to the proposed solution. For if Tib did become an NC at t , then, either there would be two distinct yet precisely colocated NCs on the mat after t , in contradiction with Exclusivity, or else Tib would have to be identified with Tibbles after all, in contradiction with their differing spatial extents, and indeed different AC v. NC statuses, before t .

invoke an ontology of distinct temporal parts composing temporally extended 'worm'-like objects or spatio-temporal hunks (Quine 1950, 1960; Lewis 1986, 202–204; Heller 1984, 1990; Sider 2001). Tibbles and Tib are distinct such things, although they share all their post- t temporal parts, since their pre- t temporal parts are all distinct: those of Tibbles strictly larger (by a tail) than those of Tib.

⁶ I draw significant inspiration from Michael Ayers' wonderful work on these topics (esp. Ayers 1974, 1991a, 1991b; part III), and also from our illuminating discussions over many years. Although it is extremely difficult to make this point precisely, it is striking that the standard approach to metaphysical puzzles like the tale of Tibbles, exemplified by many of the accounts outlined in n. 5 above, is to take as basic entities that are significantly smaller and more fleeting than NCs, and to ask how and when larger and more lasting things may be composed of them. At least in connection with the relation between NCs and their AC spatial and temporal parts, the strategy of (NCV) is precisely the reverse. See also Jones (2015) for a similar claim about the relation between ordinary objects and microscopic particles.

Now consider Tail, the smaller result of Tibbles' tail removal at t . I assume that this is an NC, according to (NCV). For it is a naturally unified persisting macroscopic material object, although one that is likely to be significantly outlasted by Tibbles, since, unless steps are taken to avoid it, Tail will rapidly decompose. Call the object consisting of Tibbles' tail before t 'Tab'. Like Tib, I take it that this is an AC grounded upon Tibbles and unified by spatial partition, this time on the basis of the concept of a tail. So we may ask where Tail comes from and what happens to Tab, at t ; and what explains the material nature of Tail at that time?

First, Tail is the result of a division of Tibbles. Normally, when an NC is divided into two NCs, at least one of these is something new that did not exist before and is created by the division.⁷ Both may be new if the initial NC is destroyed, as would be the case, for example, if a giant boulder were divided equally into two large rocks. In the current case, though, Tibbles survives tail-less. Tail is a new creation by division. Second, since Tibbles no longer has a tail after t , Tab is destroyed at that time. There is no longer an AC grounded on Tibbles by tail-based spatial partition. Third, given the way that Tail is created by division at t , it has the basic properties that Tab has when it is destroyed at that time. These in turn are derived from Tibbles by the relevant tail-based abstraction. Thus, for example, Tail's length at $t + \varepsilon$, is the extent of Tibbles that is included in the spatial partition induced by the concept of a tail at $t - \varepsilon$: the length of Tab at that time.

So far I have been discussing arbitrary spatial parts. According to (NCV), these are ACs grounded on NC wholes by spatial partition.⁸ Some of the proper spatial parts of some NCs may themselves be NCs, though, whose unity, both at

⁷ I consider exceptional cases below in which an NC survives the removal of an NC proper part. In such cases, neither NC is a new creation.

⁸ A full development of (NCV) at this point requires at least the following. First, an adequate articulation of the nature of ACs: what exactly are such things? I work here with the basic idea that ACs are dependent individuals grounded upon NCs by a form of abstraction I call spatial partition. More is clearly required. Second, an account of the way in which their basic properties are derived from their grounding NCs by the relevant mode of spatial partition. Third, an explanation of why their precise colocation is therefore unproblematic, as against the Exclusivity of NCs. See my "Exclusive Individuals" (2015) for an exploration, in connection with the parallel case of temporal partition, of the idea that ACs are something like perduring individual processes: grounding NCs having certain artifact-properties or playing certain roles: a lump of clay's being a statue, for example. The corresponding proposal here would be that Tab is something like the process of Tibbles' having a tail. This suggests that Tail is 50 cm long, for example, just if Tibbles has a tail 50 cm-ly, in other words, just if the region of Tibbles delineated by our concept of a tail is 50 cm in length. Then the possible colocation of ACs will be no more problematic than the fact that the process of my waiting on the street corner is

a time and over time, is entirely independent of the concepts involved in their identification. Plausible candidates for this status are certain organs of animals, and their individual teeth, say; and the leaves and fruit of certain plants.⁹ These may lead to exceptions to the principle cited as the normal case above, that when an NC is divided into two NCs, at least one of these is something new that did not exist before and is created by the division. For when my right kidney is removed successfully, say, I survive, as does that NC proper part. Neither of these is created anew by the division.

It is straightforward to prove that an NC may not survive the loss of the complement of any of its NC proper parts. Suppose that p is an NC proper part of NC o . Suppose further for reductio that o may survive the loss at time t of the complement of p , p' : all of o except for p . Then, by the argument given at the outset concerning Tibbles, we have a contradiction. For p remains unchanged, precisely coincident with o that survives its reduction in size at t . Both o and p are NCs. Hence $o = p$ by Exclusivity. Yet $o \neq p$, since p is a proper part of o before t . This is a contradiction. So o may not survive the loss of p' at t . If p' is destroyed, then all that remains of o is the distinct proper part p . o itself is no more.

How does this result bear on what I offered above as plausible candidates for the status of NC proper parts of NCs: certain organs of animals, and their individual teeth, say; and the leaves and fruit of certain plants? Well, an animal does not survive the loss of everything but its right kidney, its heart, or its lower left incisor. If all the rest of the animal is destroyed, then the animal itself is no more. Similarly, an individual plant fails to survive the loss of everything but a single leaf or fruit, even if a distinct new plant of the same kind may be produced by that very fruit. But what about the brain and, in particular, the human brain? Here we have to be especially careful given an inevitable interaction with complex issues concerning personal identity. Still, I think that (NCV) is in the clear.

Consider first of all a case in which questions of personal identity are beside the point. If all but the brain of a cat is destroyed, then surely the cat itself is no more. All that remains is a distinct NC – a brain – that was previously a proper

located precisely where I am then, namely, on the street corner to precisely my extent. These are currently mere gestures in the direction of a possible elaboration of (NCV).

⁹ As with NC status in general, these are only plausible candidates of NC proper parts of NC wholes. Further empirical and theoretical investigation may force revision in any particular case. There are ACs unified by any conceptual spatial partition of an NC. Some, but only relatively few, of these unproblematically coincide with NC proper parts. In such cases reference by the relevant partition characterization naturally falls to that NC part. In what follows I assume that my plausible candidates are indeed examples of this phenomenon.

part of the NC animal that has been destroyed. Ignoring questions of personal identity, I see no reason to think any differently about the case of a human being. If all but the brain of a human being is destroyed, then surely that animal itself is no more. All that remains is a distinct NC that was previously a proper part of the human being that has been destroyed.¹⁰

Things become difficult for (NCV) only if it conjoins the current admission that a human being's brain is an NC proper part of that NC animal whole with two further claims about persons. Put in the first person, these are (a) I am (identical to) a human animal; and (b) I may survive even if all of me is destroyed except for my brain. The result is that an NC may survive the loss of all of itself except for an NC proper part. Yet this is inconsistent with the general (NCV) strategy in response to cases in which part of an animal, or indeed an NC generally, is lost. Either the animal does not survive the loss, as, for example, when all of Tibbles except for his tail is destroyed. Or the animal does survive; and what remains is neither identical to nor precisely colocated with any NC that was previously a proper part of that animal, although it may be precisely colocated with an AC part unified by spatial partition, as, for example, when Tibbles' tail is destroyed.

This simply shows that (NCV) must reject the conjunction of (a) and (b). The issues here are certainly complex and controversial; but that response is surely independently defensible. The basic thought would be that an account of personal identity on which persons are material objects for which (b) is true must, following Mackie (1976, ch. 6), identify persons with brains in opposition to the identification in (a) of persons with whole human animals of which brains are proper parts. So this version of (NCV) may again reject, as it must, the possibility that an NC might survive the loss of the complement of any of its NC proper parts. I would myself be inclined instead to accept (a) and reject (b), likewise avoiding any objection.

Now, animals may certainly survive the loss of the plausible candidates for their NC proper parts that I offer above, a kidney, or a single tooth, say.¹¹ So a

¹⁰ See Madden (MS) for a different view of these cases.

¹¹ The (human) brain is once again a complicated case here, and this is not the place to address all the complications. Still, it seems to me that it is not out of the question for (NCV) to claim that, just as a cat or a human being may survive the loss of its right kidney or its left lower incisor, it may also, in the relevant sense survive the loss of its brain. Survival here simply means that there is after the loss an NC numerically identical with the animal that we began with, not necessarily that this NC is a living animal of the relevant kind. Loss of the brain, by spontaneous dissolving in acid, for example, is simply a peculiarly horrific mode of death. The animal remains, a brainless carcass, at least until it decomposes. Unlike its rejection of the possibility that an NC might survive the loss of the complement of an NC proper part, though, this line is not, so far as I can see, essential to the view. (NCR) may accept that an NC might

version of (NCV) that embraces these as genuine examples of NC proper parts of NCs must also deny that the complement of any NC proper part of an NC is necessarily itself an NC. For suppose that that principle is correct, and we call all of Tibbles except for his lower left incisor ‘Gappy’. It follows that Gappy is an NC: it is the complement of an NC proper part of NC Tibbles. Yet Tibbles may certainly survive the loss of its complement incisor. Gappy survives too, as an NC precisely colocated with Tibbles, and hence identical to Tibbles by Exclusivity. Yet Gappy was a proper part of Tibbles and is therefore distinct. We have a contradiction. So the (NCV) strategy is undermined. Hence the principle that the complement of any NC proper part of an NC is necessarily itself an NC must be rejected.

Once again, though, I see no good reason to endorse the problematic principle from the point of view of (NCV). Suppose that an NC, o , has an NC proper part, p . That is to say, p , is naturally unified: its unity, both at a time and over time, is entirely independent of our concepts. Still, the natural unification of a persisting material object that encompasses the complement of p in o , p' , may nevertheless extend to assimilate p , at least whilst it is there to be so assimilated. If p were to be removed in such a way that o survives, then that very same unification of the surviving NC, o , would include only what is precisely coincident with AC p' . But with p in place, it is naturally included in the unification of o , and there may yet be no natural unification of a persisting material object that excludes precisely p . Put slightly differently, natural boundaries may be asymmetric, since the principles responsible for natural unification may be quite different in the two cases of p and o . Although those controlling the unification of p may terminate at its boundary, those controlling natural unification within p' may extend beyond the boundary with p (when p is there) to assimilate and include p as a proper part of the NC whole, o . Thus, the proponent of (NCV) may reject the principle that the complement of any NC proper part of an NC is necessarily itself an NC. Indeed, rejection of this principle captures an important sense in which, according to (NCV), NCs are not in general mere composites of NC proper parts.¹²

We may also consider the addition of parts to NCs. Suppose that we have a tailless cat, Tibbles, without a lower left incisor, along with an appropriate NC incisor, Tooth, and NC tail, Tail. We may insert Tooth into Tibbles lower left incisor-gap and stitch on Tail to his stump. Both Tooth and Tail are initially

have an NC proper part such that its loss constitutes the destruction of the NC whole, although it may be difficult then to insist, as (NCV) must, that the whole may not survive the loss of the complement of that significant NC proper part.

¹² This point looms large in Section “Collection and Approximation” below.

appendages to Tibbles, who remains his previous size, with an embedded denture that may aid chewing and an aid to balance attached rather as a person may benefit from using a walking stick. Perhaps over time these additions become integrated into the NC Tibbles himself, provided that they are materially appropriate and suitably embedded/attached. Tibbles therefore increases in size and changes shape. The integrated Tooth survives as an NC proper part of NC Tibbles, who is no longer precisely colocated with AC Gappy as he previously was. NC Tail is no more, being assimilated into the body of Tibbles who is likewise no longer precisely colocated with AC Tib and acquires an AC proper part Tab grounded by spatial partition on the basis of the concept of a tail that did not exist previously. The basic properties of Tab immediately after the integration, that is to say, those derived from Tibbles by tail-based abstraction, are precisely the basic properties of Tail immediately before the integration.¹³

All of this of course raises the question what precisely constitutes such integration and assimilation of added parts by NCs when it occurs.¹⁴ All that I can say here now is that it occurs just when the unification of a single NC from within Gappy/Tib extends continuously beyond the boundary with Tooth/Tab, assimilating and including the new tooth and tail.

Returning to the initial tale of Tibbles with which this section began, the core (NCV) insight is that its fundamental flaw lies in the failure to recognize any distinction between NCs and ACs. Tibbles survives the loss of a part. Tib is defined in such a way that it is distinct from Tibbles, survives unchanged, and becomes precisely colocated with Tibbles. The assumption that Tib is of the same metaphysical kind as Tibbles himself is therefore inconsistent with the intuitive conviction that instances of that kind exclude each other from their precise location at all times at which they exist: no two distinct naturally unified persisting macroscopic material objects are ever precisely colocated. Retaining that intuition of Exclusivity and leaving everything else as it is in the commonsense tale of Tibbles therefore motivates a distinction in metaphysical kinds between Tibbles and Tib. Thus, (NCV) is born. This section has traced out some of the central commitments and implications of the view.

¹³ Note the symmetry here with the cases considered earlier of the loss of a tail and a tooth.

¹⁴ See Van Inwagen (1990, chs. 3, 6, & 7) for discussion of closely related issues, although firmly within the framework of the ‘bottom-up’ approach with which I contrast my own in n. 6 above.

4 Collection and Approximation

So far I have been concerned with the grounding of ACs upon NCs by spatial partition. Given a domain of NCs, it is also possible to construct ACs by collection and approximation. These forms of metaphysical grounding are the topic of the current section. Here matters become significantly more complicated and my views are even less fully worked out.

Consider, to begin with, the complete chess set in a box on the table before me. So far as (NCV) is concerned, what is in the box is a collection of 32 individual NCs, each a specifically shaped piece of wood, or plastic, let's say. Given the context, though, it invites the consideration of at least three quite different ACs. Indeed, these may perhaps be better thought of as three nodes on a complex web of ACs varying along each of the three dimensions that they highlight.

First, there is the Simple Plurality of precisely those pieces, individuated by the identities of its 32 NC members, C_1, \dots, C_{32} . This exists at a time if and only all 32 of the pieces before me exist at that time; and it is located at a time where they are then, which may be massively scattered. A Simple Plurality of NCs NC_1, \dots, NC_n is identical to this first AC chess set iff $n = 32$ and $NC_1 = C_1, \dots, NC_{32} = C_{32}$.¹⁵

Second, there is also a distinct Role Collection AC unified by the near-continuous fulfilment over space and time of the salient and intended role of being an appropriately related Simple Plurality of pieces suitable for playing chess. Thus, a rook amongst those before me now may be lost and replaced by a plastic piece from another set, a pawn may be replaced by a coin; and one of the wooden bishops in the box now may be destroyed by being dropped and splitting into a number of pieces, most of which are discarded, except for the tiny base portion that is retained for use as a distinct descendent bishop in future games of chess¹⁶; and so on. A limiting case of such a Role Collection, in which the collected Simple Pluralities are individual NC human beings, would be the Prime Minister of the United Kingdom under Elizabeth II: this is a collection consisting of Winston Churchill between 26 October 1951 and 7 April 1955, Antony Eden between 7 April 1955 and 10 January 1957, ... David Cameron between 11 May 2010 Similarly, in the case of a chess set, an AC Role Collection is a collection over times of Simple Pluralities of pieces fulfilling, or

¹⁵ Compare Fine's (1999) rigid embodiments.

¹⁶ See my "Exclusive Individuals" (2015) for extended discussion of this kind of case in connection with a banknote undergoing various interventions: the particular paper NC may be destroyed and replaced by a distinct but related piece of paper to which it passes on the role of being useable as currency.

at least suited to fulfil, the role of a chess set: one Simple Plurality between t_1 and t_2 , a second between t_2 and t_3 , and so on. This exists at a time provided that there is an appropriate descendent Simple Plurality suited to realize this role at that time; and it is located at a time where the members of that plurality are then. Role Collections are identical iff they collect identical Simple Pluralities at all and only the same times.¹⁷

Third, we may approximate the contents of the box before me to a genuine NC that may survive both the loss, with or without replacement, of a 'part' and the failure to fulfil any salient or intended role. I may in this sense preserve the chess set before me, the one that my grandfather gave me, say, in spite of the fact that a pawn is destroyed and never replaced, and so it no longer fulfils the role of a chess set. Indeed, successive pawns may be destroyed each year until there are none left. Unified by approximation to an NC we may say that my grandfather's chess set nevertheless remains as a collection of 16 'back row' pieces. A plastic chess set may even persist in this sense if all of the pieces melt together into a single black and white lump, at which point the pretence of approximation becomes a reality. What results may be an individual NC created by the fusing of NC pieces that are thereby destroyed, with which the persisting AC chess set becomes precisely colocated. I call ACs unified by approximation in this way ~Natural Continuants, ~NCs. Because this mode of grounding upon genuine NCs in general involves a degree of approximation, it is not possible to give precise existence and identity conditions for the ACs involved. Furthermore, it is perhaps the least salient AC to consider in the current case of a chess set. Nevertheless, I suggest in what follows that there are many cases in which this third way of thinking is apt to dominate, and once again it is crucial to distinguish clearly between genuine NCs and such ~NC ACs.

Consider for example a more robust assemblage of NCs constructed for the purpose of fulfilling a specific and valuable function such as the watch before me. This is the result of assembling a determinate plurality of distinct NCs for the purpose of fulfilling the 'timing-telling' role, *W*. Again we can think in at least three ways about what is present: there are at least three distinct relevant (varieties of) ACs before me.

¹⁷ Compare Fine's (1999) variable embodiments. Note also that the conditions that successive realizing pluralities constituting Role Collections should be 'appropriately related' to an originating Simple Plurality and 'suited to fulfill' the defining role *R* introduce a degree of indeterminacy. Strictly speaking there are many distinct such ACs, depending, for example, upon (a) how many, if any, of the originating Simple Plurality of NCs must be retained; and (b) how far from actually realizing *R* successive Simple Pluralities may be.

First, there is the Simple Plurality of precisely those n NCs that are currently assembled so as to fulfil W . This is individuated by the identities of its members; it exists at a time if and only all n of those NCs exist at that time, however disassembled and scattered they may be; and it is located at a time where they are then.

Second, there is a distinct Role Collection, or, strictly speaking, many more or less similar Role Collections, consisting of a collection over time of pluralities of NCs appropriately related to the original n watch components and nearly continuously suited to play the role W . This AC may have (some) components replaced over time. It exists at a time provided that there is an appropriate descendent plurality suited to realize W at that time; and it is located at a time where the members of that plurality are then.

Third, we may also consider the watch as an \sim NC, unified by the natural integrity and robustness of its material assembly rather than by its particular component parts or its intended functional role: we assimilate or approximate it to a genuine NC, unified, both at a time and over time, entirely independently of our concepts and activities. Unlike a Simple Plurality, this may loose parts. In this sense the watch survives even if a part or parts are destroyed over time. Unlike a Role Collection, its persistence is independent of its suitability to play the watch role W . It may get wet and parts fuse irreparably together with rust, or even get so hot that pieces of metal melt together; it may then be worn down gradually over time like a lucky coin until all that remains is a small misshapen metallic lump. In this way we consider its unity as more basic than any function of that of its NC parts, either in terms of their individual identity and persistence or in terms of their joint realization of any designated role.

Although the \sim NC conception may dominate in cases such as this, we must nevertheless distinguish such ACs unified by their approximation to NCs from genuine NCs. The proponent of (NCV) sails quite close to the wind here, but may argue for this distinction by returning to the discussion of spatial partition above. There it was established that an NC, o , may not survive the loss of the complement, p' , of an NC proper, p . Now suppose for reductio that the watch before me is an NC. Suppose further that the final phase of its construction involves sticking a gold leaf logo onto its steel back surface. Let o be the finished watch and p be its logoless proper part. So p' is the logo that was stuck onto the back surface of the watch in the final phase of its construction. Given the assumption that the finished watch is an NC, it surely follows that p is an NC proper part too. For both are equally assemblages of various parts for the purposes of fulfilling a function. Indeed, o is the result of sticking the final part p' onto p ; and that final phase of the construction may be entirely optional: equally many watches leave the production line without their gold leaf logo as

leave with it. Furthermore, if the watch really is an NC, then it may clearly survive the loss of its stick-on logo, as NCs regularly survive the loss of their minor parts. But then we have a contradiction. For *o* has survived the loss of the complement *p'* of an NC proper part *p*. Thus, our starting assumption that the watch really is an NC must be rejected. Once again, it is crucial to respect the (NCV) distinction between genuine NCs and ACs, even those unified by approximation to NCs themselves.

This argument involves sailing quite close to the wind as I say, though, since the opponent of (NCV) may play it straight back against the (NCV) account of the way in which NCs such as Tibbles may survive the loss of a part such as its tail or a tooth. Put another way, the use of this argument in the case of artefact assemblages such as my watch challenges the proponent of (NCV) to clarify the key distinction between the two cases. What justifies the claim that Tib, or Gappy, is an AC proper part grounded by spatial partition on the genuine NC whole Tibbles, whereas my watch and its logoless proper part must be regarded as metaphysically on a par with each other in such a way as to hold in place the claim that both are ACs grounded on their component parts that may be assimilated to genuine NCs only by approximation?

The simple reply here is that Tibbles is absolutely not a mere composite, or assemblage, of Tib and a tail, or of Gappy and a tooth, in the way that my watch is a mere composite of a logoless proper part and its stuck on logo. Tib, or Gappy, may only be unified top-down, by spatial partition. The logoless proper part of my watch, on the other hand, exactly like the watch itself, is instead unified bottom-up, by the assembly of its NC parts for the purpose of fulfilling a designated role.

Recall my earlier discussion of the addition of Tail and Tooth to incisorless tailless Tibbles. I made a distinction between the initial phase in which Tail and Tooth are useful appendages and the possibility of a subsequent phase in which genuine integration into Tibbles himself occurs, when the unification of a single NC from within Tib/Gappy extends continuously beyond the boundary with Tab/Tooth, assimilating and including his new tooth and tail. The current suggestion is that there is no such subsequent phase in the case of the addition of a logo to a watch, which remains an individual NC component part of a mere composite AC watch assimilated to a genuine NC by approximation.

An opponent of the (NCV) distinction between NC cats and ~NC AC watches may wish to reassert the parallel by modifying the case to consider the loss of a functionally essential part – a crucial cog, Cog, for example. The suggestion would be that the watch survives the loss of Cog, an NC proper part of a genuine NC whole; but the complement of Cog, Goc, with which the watch thereby becomes precisely colocated, is not itself an NC proper part of the watch prior

to the loss. For functional unification within Goc extends continuously beyond the boundary with Cog, assimilating and including this as part of the whole NC watch. This is strictly consistent with (NCV) as it stands, and has the advantage of including amongst NCs many functional artefacts that we might intuitively treat on a par with the animals, vegetables and (unified portions of) minerals that we have so far been including in their number.

On the other hand, the suggestion faces at least two objections. First, most familiar artefacts will really be mere composites of genuine artefacts and decorative appendages. For most have some non-functionally-essential NC proper parts. Indeed, who is to decide which are truly functionally-essential. There may well be equally qualified but incompatible views on this: the face of a watch is essential to keep out the rain, but not to its telling the time indoors, for example. Second, Goc may be a composite of precisely the parts of the watch that are essential to perform some other quite different function – perhaps use as a very accurate weight for measuring out precious materials. By parity of reasoning, this reinstates Goc as an NC proper part of the NC watch; and we have already agreed that the watch may survive the loss of its complement, Cog. So the contradiction is back.

My own inclination is to regard these objections as sufficient to motivate a return to the version of (NCV) that excludes such composite artefacts from the genuine NCs. These may well be regarded as AC ~NCs as outlined above, as well as Simple Pluralities of NCs or Role Collections. But the distinction between all such ACs and genuine NCs must be maintained.

In any case, the upshot of this final discussion is the following. Suppose that a candidate NC, o , has a proper spatial part with equal right to NC status, p . If o may survive the loss of the complement of p , p' , then o , and by symmetry, p , is after all at best an ~NCs grounded on the collections of their genuine NC parts by approximation. Conversely, given a genuine NC, o , any appearance of equality of right to NC status given by any of its proper spatial parts, p , of which o may survive the loss of the complement, p' , must be illusory. The unification of p must in reality be artificial: grounded upon the natural unity of o itself on the basis of some form of spatial partition.¹⁸

18 I have not discussed a quite different way of attempting to assimilate what (NCV) regards as NCs to mere composites by insisting that persisting macroscopic material objects are all mere composites of various fundamental physical particles. The relation between NCs and the particles that are where they are is a topic for another time and place. For now I simply register that I am persuaded by Jones (2015) that NCs relate one-many to pluralities of such particles: they are not composed of or constituted by any unique determinate such plurality.

5 Conclusion

The central thesis of (NCV) is that there are amongst the persisting macroscopic material objects that we perceive in the world around us Natural Continuants whose unity at a time and over time is entirely independent of our concepts and activities and that ground Artificial Continuants by approximation, collection, and partition. NCs satisfy Exclusivity; but ACs do not, either with NCs or amongst themselves. The abstract metaphysics of ACs requires grounding in the basic domain of NCs, whose natural unity at a time and over time is brute, objective, and unanalysable: a simple fact of the macroscopic material world. Failure to recognize this fundamental distinction between NCs and ACs causes significant and widespread philosophical error and confusion.

Acknowledgment: I am grateful to the following for helpful comments on previous versions of this material: Emma Borg, Josh Dever, Johan Gersel, Bob Hale, John Hawthorne, Chris Hughes, Nick Jones, Rory Madden, David Owens, David Papineau, Sebastian Rodl, Mark Sainsbury, Matt Soteriou, Nick Shea, James Stazicker, Mark Textor, and Michael Tye.

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